PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
33 048/M/Mq.		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/05468	14/06/2000	15/06/1999
International Patent Classification (IPC) or national classification and IPC G06K9/38		
Applicant ATECS MANNESMANN AG et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
02/01/2001	23.08.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Rockinger, O Telephone No. +49 89 2399 2998

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/05468

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-4	as originally filed				

Claims, No.:

1-4	as received on	15/06/2001	with letter of	12/06/2001	

Drawings, sheets:

1/2,2/2	as originally filed				

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1 - 4
	No:	Claims -
Inventive step (IS)	Yes:	Claims -
	No:	Claims 1 - 4
Industrial applicability (IA)	Yes:	Claims 1 - 4
	No:	Claims -

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1) Reference is made to the following documents:

D1: US-A-5 815 606
D2: PATENT ABSTRACTS OF JAPAN vol. 1996, no. 02, 29 February 1996 & JP-A-07 271 907
D3: FR-A-2 709 361
D4: WO 97 34 253

2) Document ***D1***, which is considered to represent the most relevant state of the art to the subject-matter of **claim 1**, discloses (the following references applying to ***D1***)

- a method for transforming by several binarization processes a digital image having several gray levels into a binary image in which each pixel is coded over one bit (whole document),
- characterized in that said several different [...] binarization processes are applied [...] to each current pixel of the digital image and in
- that the binary values delivered [...] by the various binarization processes for this current pixel are combined so as to obtain a resultant binary value constituting the corresponding pixel of the binary image

*from which the subject-matter of **claim 1** differs in that*

- the binarization processes are applied in parallel to each current pixel, and
- the binary values delivered by the various binarization processes are combined (instead of selected), so as to obtain a resultant binary value.

3) The claimed solution lacks inventive step. The parallel application of several binarization processes to each current pixel[1] must be considered to be a matter of normal design procedure, well known by a person skilled in the art of computer science. Moreover, ***D4*** discloses such a parallel application of binarization processes in the context of image processing (see e.g. figure 4, 4112A - 4112N and page 18, lines 15 - 17), a teaching which the skilled person would necessarily include within the binarization method disclosed by ***D1***. Furthermore, the skilled person would regard it as a matter of

[1] If the binarization processes are performed in parallel, they typically operate on each current pixel in parallel (i.e. this *granularity of parallelism* - for each current pixel in parallel - must be considered to be the standard approach when realising a parallel implementation of the binarization method).

normal design procedure to combine the results of the binarization processes (e.g. using a voting scheme) instead of selecting a single - typically the best - binarization result (an approach which in fact is a special case of a voting scheme). Consequently, the subject-matter of **claim 1** does not satisfy the requirements of Article 33(3) PCT.

4) The incorporation of the binarization method within an automatic mail processing machine - as claimed in **claim 2** - does not establish an inventive step. Document ***D1*** already anticipates the usage of a binarization method (***D1***; col. 4, lines 9 - 11) within an automatic mail processing machine. As it is the very purpose of a mail processing machine to fully automate the whole mail handling process (including automatic recognition of the address), the use of the binarization method of claim 1 for the binarization of the face of a mail item cannot considered to be inventive (cf. also document ***D3***).

5) The mere implementation of one of the binarization processes as neural classifier - as claimed in **claim 3** - lacks inventive step, as the skilled person would consider such an approach to be a standard solution in the field of digital image processing (cf. document ***D2***; the figure). Furthermore, the skilled person would also consult document ***D3***, which discloses the incorporation of a neural network for character recognition within a automatic mail processing device.

6) Backpropagation must be considered to be *the* standard method for the training of feed-forward neural networks of multi-layer-perceptron type. Furthermore, it is a standard design procedure to store the weights (which have been learned using the backpropagation algorithm) in order to adapt the classifier to different input data. Thus, the subject-matter of **claim 4** cannot considered to be inventive (Article 33(3) PCT).

Re Item VII

Certain defects in the international application

7) Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document ***D1*** is not mentioned in the description, nor is this document identified therein.

AMENDED CLAIMS (PCT/EP00/05468)

1. A method for transforming by several different binarization processes (T1,T2,T3) a digital image (A) having several gray levels into a binary image (F) in which each pixel is coded over one bit, characterized in that said several different binarization processes are applied in parallel to each current pixel (P) of the digital image and in that the binary values delivered in parallel at the output of the binarization processes for this current pixel are combined (T4) so as to obtain a resultant binary value constituting the corresponding pixel of the binary image.

2. The method as claimed in claim 1, in which the binarization processes (T1,T2,T3) are performed within an automatic mail processing machine to binarize the digital image of the face of mail item on which the destination address of the mail is printed.

3. The method as claimed in claim 2, in which the output of one of the binarization processes is the output of a neural classifier (T1).

4. The method as claimed in claim 3, in which the neural classifier has undergone learning phases by backpropagation for training the neural classifier on batches of mail items exhibiting the particular features of diverse spectra of mail in order to construct so many different set of weights for the neurons of the neural classifier, these various sets of weights being held in memory in the automatic mail processing machine, and in which the sets of weights can be selectively recovered so as to binarize digitized images for a specified batch of mail items.

10/018041

14

PATENT COOPERATION TREATY

PCT

REC'D 27 AUG 2001

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
33 048/M/Mq.		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/05468	14/06/2000	15/06/1999
International Patent Classification (IPC) or national classification and IPC G06K9/38		
Applicant ~~[ATECS MANNESMANN AG et al.]~~ MANNESMANN DEMATIC POSTAL AUTOMATION S.A.		

*RO/IB

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   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
02/01/2001	23.08.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Rockinger, O Telephone No. +49 89 2399 2998

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/05468

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

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Drawings, sheets:

1/2,2/2	as originally filed

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   - ☐ furnished subsequently to this Authority in written form.
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   - ☐ the claims, Nos.:

☐ the drawings, sheets:

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(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1 - 4
	No:	Claims -
Inventive step (IS)	Yes:	Claims -
	No:	Claims 1 - 4
Industrial applicability (IA)	Yes:	Claims 1 - 4
	No:	Claims -

2. Citations and explanations
see separate sheet

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see separate sheet

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D2: PATENT ABSTRACTS OF JAPAN vol. 1996, no. 02, 29 February 1996 & JP-A-07 271 907
D3: FR-A-2 709 361
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- characterized in that said several different [...] binarization processes are applied [...] to each current pixel of the digital image and in
- that the binary values delivered [...] by the various binarization processes for this current pixel are combined so as to obtain a resultant binary value constituting the corresponding pixel of the binary image

*from which the subject-matter of **claim 1** differs in that*

- the binarization processes are applied in parallel to each current pixel, and
- the binary values delivered by the various binarization processes are combined (instead of selected), so as to obtain a resultant binary value.

3) The claimed solution lacks inventive step. The parallel application of several binarization processes to each current pixel[1] must be considered to be a matter of normal design procedure, well known by a person skilled in the art of computer science. Moreover, ***D4*** discloses such a parallel application of binarization processes in the context of image processing (see e.g. figure 4, 4112A - 4112N and page 18, lines 15 - 17), a teaching which the skilled person would necessarily include within the binarization method disclosed by ***D1***. Furthermore, the skilled person would regard it as a matter of

[1] If the binarization processes are performed in parallel, they typically operate on each current pixel in parallel (i.e. this *granularity of parallelism* - for each current pixel in parallel - must be considered to be the standard approach when realising a parallel implementation of the binarization method).

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4) The incorporation of the binarization method within an automatic mail processing machine - as claimed in **claim 2** - does not establish an inventive step. Document ***D1*** already anticipates the usage of a binarization method (***D1***; col. 4, lines 9 - 11) within an automatic mail processing machine. As it is the very purpose of a mail processing machine to fully automate the whole mail handling process (including automatic recognition of the address), the use of the binarization method of claim 1 for the binarization of the face of a mail item cannot considered to be inventive (cf. also document ***D3***).

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6) Backpropagation must be considered to be *the* standard method for the training of feed-forward neural networks of multi-layer-perceptron type. Furthermore, it is a standard design procedure to store the weights (which have been learned using the backpropagation algorithm) in order to adapt the classifier to different input data. Thus, the subject-matter of **claim 4** cannot considered to be inventive (Article 33(3) PCT).

Re Item VII

Certain defects in the international application

7) Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document ***D1*** is not mentioned in the description, nor is this document identified therein.

AMENDED CLAIMS (PCT/EP00/05468)

1. A method for transforming by several different binarization processes (T1,T2,T3) a digital image (A) having several gray levels into a binary image (F) in which each pixel is coded over one bit, characterized in that said several different binarization processes are applied in parallel to each current pixel (P) of the digital image and in that the binary values delivered in parallel at the output of the binarization processes for this current pixel are combined (T4) so as to obtain a resultant binary value constituting the corresponding pixel of the binary image.

2. The method as claimed in claim 1, in which the binarization processes (T1,T2,T3) are performed within an automatic mail processing machine to binarize the digital image of the face of mail item on which the destination address of the mail is printed.

3. The method as claimed in claim 2, in which the output of one of the binarization processes is the output of a neural classifier (T1).

4. The method as claimed in claim 3, in which the neural classifier has undergone learning phases by backpropagation for training the neural classifier on batches of mail items exhibiting the particular features of diverse spectra of mail in order to construct so many different set of weights for the neurons of the neural classifier, these various sets of weights being held in memory in the automatic mail processing machine, and in which the sets of weights can be selectively recovered so as to binarize digitized images for a specified batch of mail items.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

CABINET PRUGNEAU-SCHAUB
36, rue des Petits Champs
F-75002 Paris
FRANCE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	23.08.2001
Applicant's or agent's file reference 33 048/M/Mq.	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/05468	14/06/2000	15/06/1999

Applicant
ATECS MANNESMANN AG et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Corcos, E Tel.+49 89 2399-7418

Form PCT/IPEA/416 (July 1992)

Copy for the Elected Office (EO/US) PCT/EP00/05468

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

CABINET PRUGNEAU-SCHAUB
36, rue des Petits Champs
F-75002 Paris
FRANCE

Date of mailing (day/month/year)
22 October 2001 (22.10.01)

Applicant's or agent's file reference
33 048/M/St.

IMPORTANT NOTIFICATION

International application No.
PCT/EP00/05468

International filing date (day/month/year)
14 June 2000 (14.06.00)

1. The following indications appeared on record concerning:
[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
ATECS MANNESMANN AG
Mannesmannufer 2
D-40213 Düsseldorf
Germany

State of Nationality: DE
State of Residence: DE
Telephone No.: 02 11/ 8 20-0
Facsimile No.: 02 11/ 8 20 24 73
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:
[X] the person [ ] the name [ ] the address [X] the nationality [X] the residence

Name and Address
MANNESMANN DEMATIC POSTAL AUTOMATION S.A.
14, avenue Raspail
F-94257 Gentilly Cédex
France

State of Nationality: FR
State of Residence: FR
Telephone No.: 02 11/ 8 20-0
Facsimile No.: 02 11/ 8 20 24 73
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:
[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Ingrid AULICH
Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

004389356

Copy for the Elected Office (EO/US) PCT/EP00/05468

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

CABINET PRUGNEAU-SCHAUB
36, rue des Petits Champs
F-75002 Paris
FRANCE

Date of mailing (day/month/year)
03 December 2001 (03.12.01)

Applicant's or agent's file reference
33 048/M/St.

IMPORTANT NOTIFICATION

International application No.
PCT/EP00/05468

International filing date (day/month/year)
14 June 2000 (14.06.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
MANNESMANN DEMATIC POSTAL AUTOMATION S.A.
14, avenue Raspail
F-94257 Gentilly Cédex
France

State of Nationality: FR
State of Residence: FR
Telephone No.: 02 11/ 8 20-0
Facsimile No.: 02 11/ 8 20 24 73
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address
SOLYSTIC
14, Avenue Raspail
F-94257 Gentilly Cédex
France

State of Nationality: FR
State of Residence: FR
Telephone No.: 02 11/ 8 20-0
Facsimile No.: 02 11/ 8 20 24 73
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Dominique DELMAS

Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

004506050

Copy for the Elected Office (EO/US) PCT/EP00/05468

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

To:

CABINET PRUGNEAU-SCHAUB
36, rue des Petits Champs
F-75002 Paris
FRANCE

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

Date of mailing (day/month/year)
09 November 2001 (09.11.01)

Applicant's or agent's file reference
33 048/M/St.

IMPORTANT NOTIFICATION

International application No.
PCT/EP00/05468

International filing date (day/month/year)
14 June 2000 (14.06.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
ATECS MANNESMANN AG
Mannesmannufer 2
D-40213 Düsseldorf
Germany

State of Nationality: DE
State of Residence: DE
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address
MANNESMANN DEMATIC POSTAL AUTOMATION S.A.
14, avenue Raspail
F-94257 Gentilly Cédex
France

State of Nationality: FR
State of Residence: FR
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

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[X] the receiving Office
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34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Ingrid AULICH
Telephone No.: (41-22) 338.83.38

PA JT COOPERATION TREAT

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

CABINET PRUGNEAU-SCHAUB
36, rue des Petits Champs
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FRANCE

Date of mailing (day/month/year)
20 November 2001 (20.11.01)

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PCT/EP00/05468

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Facsimile No.: 02 11/ 8 20 24 73
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [X] the nationality [X] the residence

Name and Address
MANNESMANN DEMATIC POSTAL AUTOMATION S.A.
14, avenue Raspail
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State of Residence: FR
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Facsimile No.: 0033 475 40 72 59
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3. Further observations, if necessary:

4. A copy of this notification has been sent to:

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[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Ingrid AULICH
Telephone No.: (41-22) 338.83.38

PA. JT COOPERATION TREAT.

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 12 February 2001 (12.02.01)	
International application No. PCT/EP00/05468	**Applicant's or agent's file reference** 33 048/M/St.
International filing date (day/month/year) 14 June 2000 (14.06.00)	**Priority date** (day/month/year) 15 June 1999 (15.06.99)
Applicant BENYOUB, Belkacem et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   02 January 2001 (02.01.01)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

S. Mafla

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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21 December 2000 (21.12.2000)

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(10) International Publication Number
WO 00/77718 A1

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99/07545 15 June 1999 (15.06.1999) FR

(71) Applicant *(for all designated States except US)*: ATECS MANNESMANN AG [DE/DE]; Mannesmannufer 2, D-40213 Düsseldorf (DE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: BENYOUB, Belkacem [DZ/FR]; 500, residence les Eaux Vives, F-91120 Palaiseau (FR). EL BENOUSSI, Hicham [MA/FR]; 17, rue Vasco de Gama, F-75015 Paris (FR).

(74) Agent: MEISSNER, P., E.; Meissner & Meissner, Hohenzollerndamm 89, D-14199 Berlin (DE).

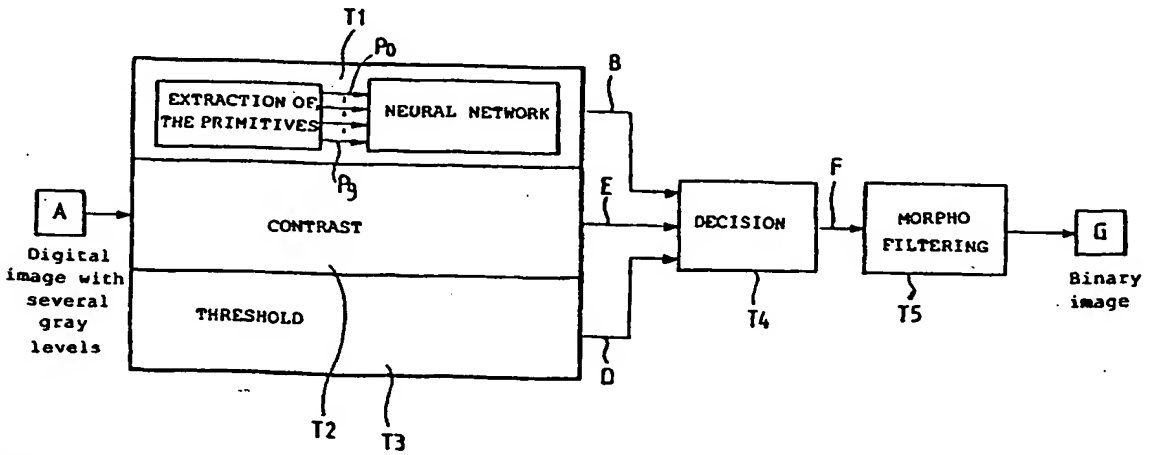
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: IMAGE BINARIZATION METHOD



(57) Abstract: The method for transforming a digital image (A) having several gray levels into a binary image (F) in which each pixel is coded over one bit, consists in applying, to each current pixel (P) of the digital image having several gray levels, several different parallel binarization processes (T1, T2, T3) each delivering as output a binary value for this current pixel and in combining (T4) the binary values delivered by the various binarization processes for each current pixel of the digital image having several gray levels so as to obtain a resultant binary value constituting the corresponding pixel of the binary image.

WO 00/77718 A1

IMAGE BINARIZATION METHOD

The invention relates to a method of transforming a digital image having several gray levels into a binary image in which each pixel is coded over one bit. It applies most particularly to automatic mail processing machines. In the automatic processing of mail, it is usual to provide a camera between the unit for taking mail items from the stack and the unit for sorting these mail items, this camera producing a digital image with several gray levels of the face of each mail item on which the destination address of the mail is printed. This digital image having several gray levels is used to carry out automatic recognition of the characters of the address and subsequently automatic reading of the address so as to operate the downstream sorting unit.

The automatic character recognition processes are applied to binarized images, that is to say images in which each pixel is coded over a single bit. In the digital image with several gray levels, each pixel is generally coded over one byte, that is to say over eight bits.

Hitherto, to transform a digital image having several gray levels into a binary image, the mail processing sector has made use of processing by dynamic thresholding consisting in calculating, for each pixel of the digital image having several gray levels, the local contrast level within a certain neighborhood of this pixel, this contrast level making it possible to calculate a local threshold with which the gray level of the pixel is compared for the coding of the corresponding pixel in the binary image. For example, if the gray level of the current pixel is less than or equal to the local contrast level of this pixel, the corresponding pixel of the binary image is white and in the converse case it is black. The binary image therefore comprises only black or white pixels. There are other processes for binarizing a digital image having several gray levels, for example the static thresholding process according to which the gray level of each pixel of the image to be binarized is compared with a fixed threshold or else processes using operators such as the gradient, the Laplacian, the standard deviation, etc.

Within the postal mail sector, the characters printed on the mail items exhibit great variability which is due to the local practices of each country as regards the printing of addresses on mail items as well as to the use of different printing supports. It follows that by applying the same binarization process to a wide spectrum of mail items, a great diversity is obtained in the quality of the binary images. The latter do not always retain the original geometrical structure or the connectedness of the characters of the images having several gray levels. The interconnecting of the characters, when they are very close together, and their sinkage, when they are abnormally thick are not always taken into account in the binary images. Likewise, the weak contrasts which may constitute elements characteristic of the shape of the characters are not always recovered within the binary image whereas smudges on the character printing support may be recovered within the binary image.

The aim of the invention is therefore to propose a method for transforming a digital image having several gray levels into a binary image which remedies the drawbacks indicated above.

To this end, the subject of the invention is a method for transforming a digital image having several gray levels into a binary image in which each pixel is coded over one bit, which consists in applying, to each current pixel of the digital image having several gray levels, several different parallel binarization processes each delivering as output a binary value for this current pixel and in combining the binary values delivered by the various binarization processes for each current pixel of the digital image having several gray levels so as to obtain a resultant binary value constituting the corresponding pixel of the binary image.

This multiprocess approach allows the best account to be taken of the diversity of printing of the characters in the digital images having several gray levels of mail items. The combining of the binary values at the output of the binarization processes makes it possible to adapt the definitive coding of the pixel in the binary image as a function of the specific characteristics of the mail items to be processed.

The binarization processes can include bandpass processes of dynamic or static thresholding type, high-pass processes with the aid of computational operators of the differential type (gradient, Laplacian) and low-pass processes with the aid of computational operators of the integrator type.

According to a particular feature of the method according to the invention, these binarization processes can in part be carried out by a neural classifier. For each pixel of the digital image to be binarized, the neural classifier is supplied with a vector of values characterizing the environment of this pixel in this image and on the basis of this vector of characteristic values, the neural classifier produces a binary value for this pixel. The use of a neural classifier is particularly advantageous for processing very different spectra of mail items on one and the same machine. This is because it is sufficient to carry out learning phases for training the neural classifier on batches of mail items exhibiting the particular features of the diverse spectra of mail so as to construct so many sets of neuron weights for the neural classifier. By holding these various sets of neuron weights in memory in the automatic mail processing machine, it is possible easily to adapt the binarization procedure to mail items of a certain type by loading the set of neuron weights which best suits mail items of this type.

The method according to the invention and its implementation are described in greater detail hereinbelow and illustrated in the drawings.

Figure 1 depicts a schematic diagram of the method according to the invention.

Figure 2 illustrates a window of 9 × 9 pixels of a digital image having several gray levels.

The method for transforming a digital image having several gray levels into a binary image according to the invention is therefore more particularly intended to be implemented in an automatic mail processing machine.

Hereinbelow, a digital image having several gray levels will be regarded as being an image produced as a square grid of pixels with a specified density of pixels per millimeter, for example 8 pixels per millimeter in both directions. Each pixel of this image is for example coded over 8 bits and therefore with a total dynamic range of 256 gray levels.

Figure 1, the transformation of a digital image having several gray levels A into a binary image F is therefore achieved according to the method of the invention by the parallel application of several different binarization processes such as T1, T2, T3, performed in pipeline mode on the image A. Each binarization process delivers as output a binary intermediate image and the pixels of the binary images B, E, D respectively produced by the processes T1, T2 and T3 are combined in a decisive process T4 so as to obtain a resultant binary image F whose pixels are exclusively white or black.

An additional morphological filtering process T5 can advantageously be applied to the image F to produce an image G of better quality than the image F. In particular, this process T5 can make it possible to eliminate the white pixels or the black pixels from the image F both within the background and within the outline as well as from the boundaries between these two categories of pixel of the image.

Generally, each binarization process such as T1, T2 and T3 is an iterative process which is applied to all the pixels of the image A and we shall denote by P the current pixel of the image A which is being processed in the course of an iteration of a binarization process.

The binarization processes which can be paralleled are of the bandpass, high-pass or low-pass type. The binarization processes illustrated by Figure 1 are the static thresholding process such as T3 or the local contrast process by dynamic thresholding such as T2 which are two bandpass type processes. In the static thresholding process, the gray level of the current pixel is simply compared with a fixed threshold so as to assign the value 0 or 1, corresponding for example to a white pixel or a black pixel respectively, to the corresponding pixel in the binary image D. The principle of dynamic thresholding has already been set forth above.

The principle of the method according to the invention is to obtain, for each pixel of the image A, several binary values 1 or 0 produced in parallel by so many different binarization processes, that is to say the corresponding pixels of the images B, E, D, and to combine these binary values 1 or 0 so as to code the corresponding pixel of the binary image F to 1 or 0. It will be understood that this combining of the binary values makes it possible to favor this or that binarization process as a function of the type of mail items to be processed to obtain the resultant binary image F. This combining could also be based on the principle of majority voting.

In the method according to the invention, certain of the parallel binarization processes can be carried out by a neural classifier. As may be seen in particular in Figure 1, the output of the process T1 is the output of a neural classifier. To simplify the subsequent description, the expression neighborhood of a current pixel P in the image A will refer to a square matrix of pixels at the center of which the current pixel P is located. Figure 2 illustrates a neighborhood of the pixel P consisting of a square matrix of 9 × 9 pixels such as pixels 1 to 8.

The neural classifier can be of the MLP type (Multi Layer Perceptron) with one or more hidden layers. The principle of operation of this neural classifier is to translate into a binary value, a vector of data characterizing the environment of a current pixel P of the image A. By way of example, this neural classifier can have an input layer with 10 neurons to which are applied 10 data characteristic of a current pixel P which were extracted by computational primitives P0 to P9 detailed hereinbelow by way of non-limiting example.

The primitive P0 simply extracts the gray level of the current pixel P. This datum corresponds to one of the 256 gray levels and is coded on one byte.

The primitives P1, P2 and P3 respectively compute the average gray levels about the pixel P for different neighborhoods thereof in the image A, typically in matrices of 3 × 3 pixels, of 7 × 7 pixels and of 13 × 13 pixels.

The primitives P4 and P5 respectively compute the maximum deviation of the gray levels of the pixels in different neighborhoods of a pixel P in the image A, typically in matrices of 7 × 7 pixels and of 13 × 13 pixels.

The primitives P6 and P7 compute the standard deviation of the gray levels of the pixels in different neighborhoods of the pixel P, typically in square matrices of 7 × 7 pixels and of 13 × 13 pixels.

The primitive P8 computes the local contrast level in a neighborhood of the pixel P, typically a matrix of 13 × 13 pixels. Here, this primitive corresponds in part to the binarization process T2.

Finally, the primitive P9 extracts the gradient over four directions in a neighborhood of the pixel P, typically a matrix of 3 × 3 pixels.

The weights of the neurons of the neural classifier are obtained by learning according to the method of backpropagation from synthesized binary images. These images are synthesized so as to orient the network of neurons in the direction desired; for example, to avoid sinking the thick characters, one uses a high proportion of synthesized images which represent thick characters; in the nominal case these images are in proportion representative of the actual mail. It is advantageous to carry out several learning phases so as to construct several sets of weights for the neurons of the classifier so that each set of weights is more particularly adapted to mail items to be processed of a certain type. The parallel processes T1, T2 and T3 can be implemented within an ASIC circuit and are all parametrizable. In the phase of use in a mail processing machine, various thresholding parameters of the processes T2 and T3, various computational parameters of the primitives P0 to P9 and various sets of weights of the neurons of the neural classifier of the process T1 can be held in memory in the automatic mail processing machine so that it is conceivable to be able to recover them selectively so as to parametrize the ASIC circuit before commencing a binarization procedure on a particular batch of mail items.

CLAIMS

1. A method for transforming a digital image (A) having several gray levels into a binary image (F) in which each pixel is coded over one bit, is one which consists in applying, to each current pixel (P) of the digital image having several gray levels, several different parallel binarization processes (T1, T2, T3) each delivering as output a binary value for this current pixel and in combining (T4) the binary values delivered by the various binarization processes for each current pixel of the digital image having several gray levels so as to obtain a resultant binary value constituting the corresponding pixel of the binary image.

2. The method as claimed in claim 1, in which the output of one of the binarization processes (T1) is the output of a neural classifier.

3. The use within an automatic mail processing machine, of a neural classifier for transforming a digital image having several gray levels into a binary image.

4. The use of a neural classifier as claimed in claim 3, in which the neural classifier has undergone several learning phases by backpropagation in order to construct so many different sets of weights for the neurons of the neural classifier, these various sets of weights being held in memory in the automatic mail processing machine, and in which these sets of weights can be selectively recovered so as to binarize digitized images for a specified batch of mail items.

FIG_1

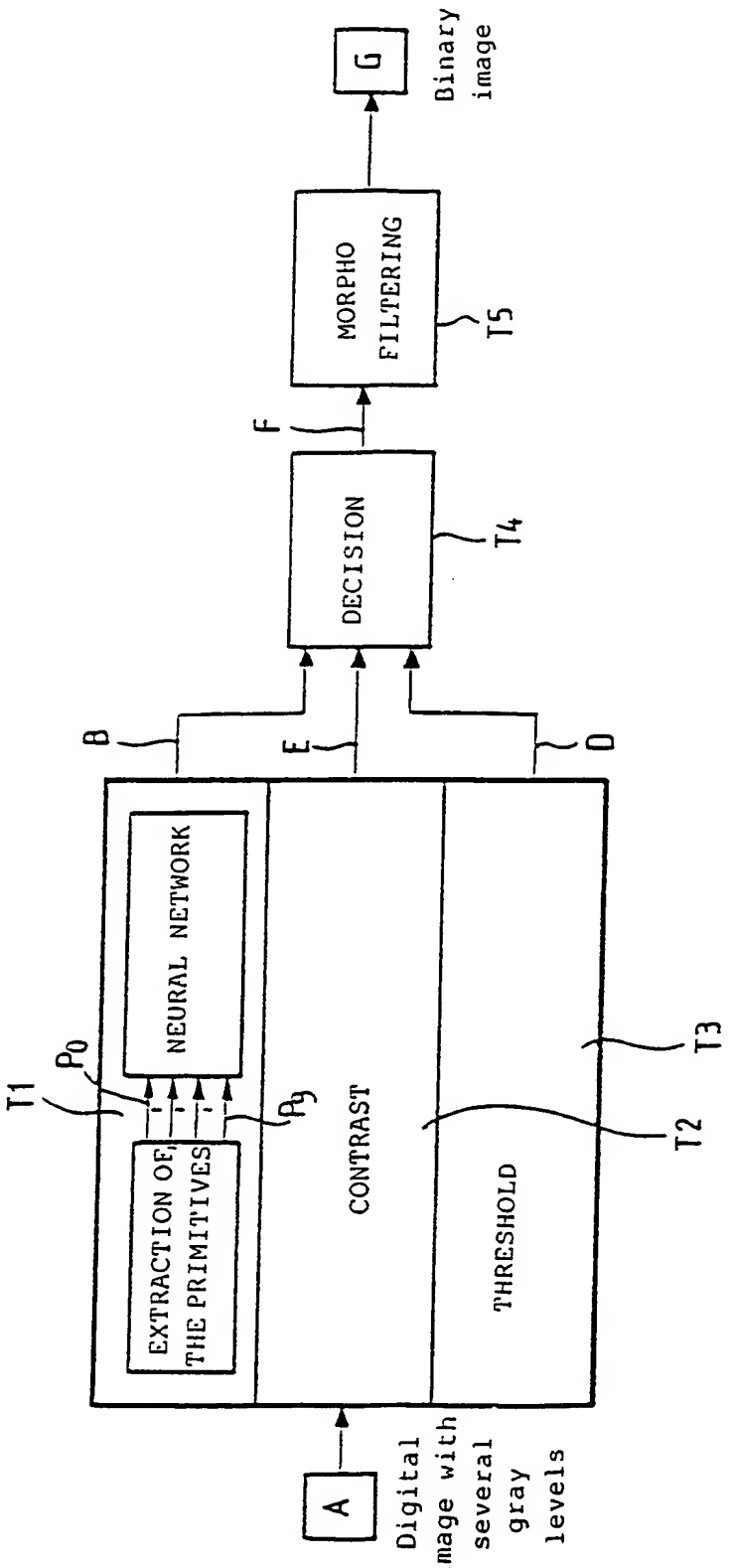
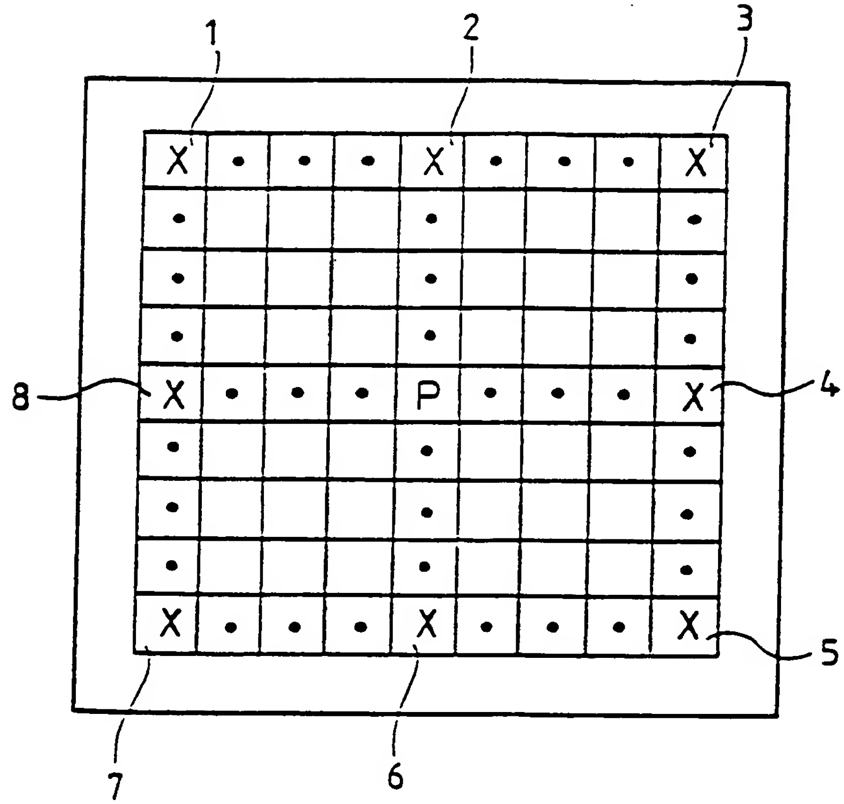

A
Digital image with several gray levels
THRESHOLD
CONTRAST
EXTRACTION OF THE PRIMITIVES
NEURAL NETWORK
T1
P0
Pj
T2
T3
B
E
D
DECISION
T4
F
MORPHO FILTERING
T5
G
Binary image

FIG_2



INTERNATIONAL SEARCH REPORT

Inte. ..ional Application No
PCT/EP 00/05468

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K9/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06K G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5 815 606 A (HEIDEN GARY M ET AL) 29 September 1998 (1998-09-29) column 2, line 7 - line 9; claim 1	1 2-4
Y	EP 0 467 577 A (SONY CORP ;CALIFORNIA INST OF TECHN (US)) 22 January 1992 (1992-01-22) claim 1	2-4
A	EP 0 750 272 A (TOKYO SHIBAURA ELECTRIC CO) 27 December 1996 (1996-12-27)	
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 02, 29 February 1996 (1996-02-29) & JP 07 271907 A (SUZUKI MOTOR CORP), 20 October 1995 (1995-10-20) abstract	2-4

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
2 August 2000	08/08/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Pierfederici, A

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INTERNATIONAL SEARCH REPORT

Inter[illegible]pplication No
PCT/EP 00/05468

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 06, 28 June 1996 (1996-06-28) & JP 08 030728 A (SUZUKI MOTOR CORP), 2 February 1996 (1996-02-02) abstract -----	2-4

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte. Application No
PCT/EP 00/05468

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5815606 A	29-09-1998	NONE	
EP 0467577 A	22-01-1992	US 5091965 A	25-02-1992
		DE 69121812 D	10-10-1996
		DE 69121812 T	30-01-1997
		JP 4227590 A	17-08-1992
EP 0750272 A	27-12-1996	JP 9006957 A	10-01-1997
		DE 69608170 D	15-06-2000
		US 5784500 A	21-07-1998
JP 07271907 A	20-10-1995	NONE	
JP 08030728 A	02-02-1996	NONE	

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
33 048/M/St.		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/EP 00/ 05468	14/06/2000	15/06/1999
Applicant		
ATECS MANNESMANN AG et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   IMAGE BINARIZATION METHOD

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 1

   [ ] as suggested by the applicant.

   [X] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PC[redacted]P 00/05468

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K9/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06K G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, INSPEC, WPI Data

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-/--

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 August 2000	08/08/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Pierfederici, A

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INTERNATIONAL SEARCH REPORT

[redacted]

Inter[redacted]al Application No
PC[redacted] 00/05468

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 06, 28 June 1996 (1996-06-28) & JP 08 030728 A (SUZUKI MOTOR CORP), 2 February 1996 (1996-02-02) abstract -----	2-4

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter[redacted]al Application No
PCT/EP 00/05468

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5815606 A	29-09-1998	NONE	
EP 0467577 A	22-01-1992	US 5091965 A	25-02-1992
		DE 69121812 D	10-10-1996
		DE 69121812 T	30-01-1997
		JP 4227590 A	17-08-1992
EP 0750272 A	27-12-1996	JP 9006957 A	10-01-1997
		DE 69608170 D	15-06-2000
		US 5784500 A	21-07-1998
JP 07271907 A	20-10-1995	NONE	
JP 08030728 A	02-02-1996	NONE	

Patent Abstracts of Japan

PUBLICATION NUMBER : 07271907
PUBLICATION DATE : 20-10-95

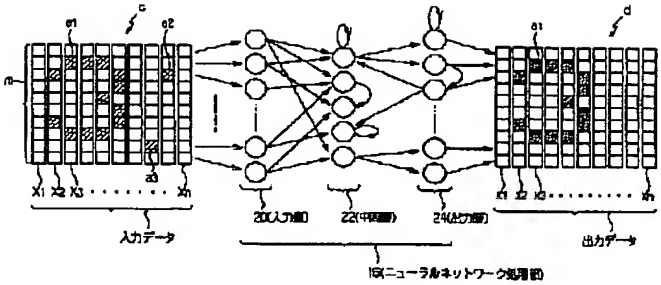
APPLICATION DATE : 31-03-94
APPLICATION NUMBER : 06085519

APPLICANT : SUZUKI MOTOR CORP;

INVENTOR : ONO KATSUICHI;

INT.CL. : G06K 9/38 H04N 1/403

TITLE : BINARIZING DEVICE FOR ANALOG IMAGE



ABSTRACT : PURPOSE: To binarize the analog images with high precision and with no influence of noises, etc.

CONSTITUTION: An analog image binarizing device includes an analog image input part where an analog image including a character a1 is inputted and a differential image production part where the difference is calculated between the mean value of density of the outer circumferential part and the density of each pixel of the analog image so that a differential image (c) is obtained. Furthermore an input data production part is added to produce the input data X1-Xn by dividing the image (c) into pixels for each row, together with a neural network processing part which binarizes the data X1-Xn by the neural network processing and converts these input data into the output data x1-xn, and a binarized image output part which synthesizes the data x1-xn into a binarized image (d) and outputs this image.

Patent Abstracts of Japan

PUBLICATION NUMBER : 08030728
PUBLICATION DATE : 02-02-96

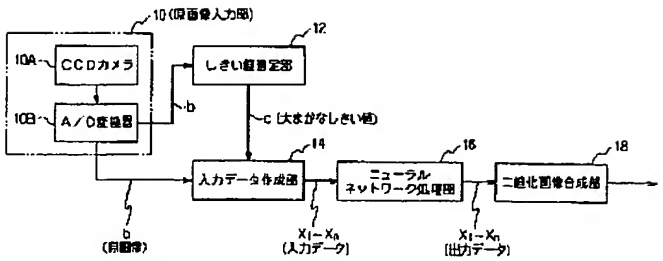
APPLICATION DATE : 12-07-94
APPLICATION NUMBER : 06182951

APPLICANT : SUZUKI MOTOR CORP;

INVENTOR : ONO KATSUICHI;

INT.CL. : G06K 9/38 G06F 15/18 G06T 5/00

TITLE : BINARIZATION DEVICE FOR IMAGE



ABSTRACT : PURPOSE: To perform highly accurate binarization without being influenced by noise and contrast, etc.

CONSTITUTION: This device is provided with a source image input part 10 for image-picking up images provided with a recognition processing object a1 and converting the image picked-up analog image data to source image data (b) provided with gradation, a threshold value selection part 12 for calculating a threshold value (c) for correction for the binarization of the source image data (b), an input data preparation part 14 for preparing input data X1 to Xn by correcting the density level of the source image data (b) based on the threshold value (b) for the correction and normalizing the source image data (b) and a neural network processing part 16 for binarizing the input data X1 to Xn prepared by the input data preparation part 14 by a neural network processing and converting them to output data x1 to xn.

INTERNATIONAL SEARCH REPORT

Inte. ..ional Application No
PCT/EP 00/05468

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K9/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06K G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 815 606 A (HEIDEN GARY M ET AL) 29 September 1998 (1998-09-29)	1
Y	column 2, line 7 - line 9; claim 1	2-4
Y	EP 0 467 577 A (SONY CORP ;CALIFORNIA INST OF TECHN (US)) 22 January 1992 (1992-01-22) claim 1	2-4
A	EP 0 750 272 A (TOKYO SHIBAURA ELECTRIC CO) 27 December 1996 (1996-12-27)	
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 02, 29 February 1996 (1996-02-29) & JP 07 271907 A (SUZUKI MOTOR CORP), 20 October 1995 (1995-10-20) abstract	2-4

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 August 2000	08/08/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Pierfederici, A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte[redacted] Application No
PCT/EP 00/05468

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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EP 0467577 A	22-01-1992	US 5091965 A	25-02-1992
		DE 69121812 D	10-10-1996
		DE 69121812 T	30-01-1997
		JP 4227590 A	17-08-1992
EP 0750272 A	27-12-1996	JP 9006957 A	10-01-1997
		DE 69608170 D	15-06-2000
		US 5784500 A	21-07-1998
JP 07271907 A	20-10-1995	NONE	
JP 08030728 A	02-02-1996	NONE	